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Discovering the diversity of the genus *Apterotrypa* Gorochov (Orthoptera, Oecanthidae, Neometrypini)

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Abstract

Apterotrypa Gorochov, 2017 is a genus with notable diagnostic characteristics, such as the absence of wings and acoustic communication, traits generally essential for crickets. Exclusive to the neotropical region, *Apterotrypa* was recently elevated from subgenus to genus and currently includes only three described species. In this study, three new species of *Apterotrypa* are described based on detailed morphological analyses of adult males and females. The species *A. assymmetrica* Tonon & Campos, **sp. nov.**, *A. hepatica* Tonon & Campos, **sp. nov.**, and *A. endolongata* Tonon & Campos, **sp. nov.** represent the first records of the genus in Brazil, collected in Pacoti (State of Ceará), Itamaraju (State of Bahia), and Corupá (State of Santa Catarina), respectively. These findings double the number of known species in the genus to six and significantly expand its geographical range from northern to southern South America. Additionally, an updated identification key and a distribution map for the genus are presented. New insights into the biology of *Apterotrypa*, including potential behaviors, communication, and reproduction strategies, are discussed based on morphological observations and comparisons with related taxa.

Keywords

Cricket, morphology, neotropical region, new species, taxonomy

Introduction

The taxonomic knowledge of Orthoptera in the Neotropical region remains insufficient, with significant research gaps and a scarcity of specialists worldwide—especially those focusing on this region. The order Orthoptera, encompassing over 30,000 described species (Cigliano et al. 2025), is the most diverse within Polyneoptera, a clade of 10 insect orders (Wheeler et al. 2001, Evangelista et al. 2019). Orthopterans inhabit a wide range of environments globally and are distinguished by traits such as hind legs adapted for jumping, sound production through stridulation, tympanal organs for sound reception, and chewing-type mouthparts. Divided into two suborders, Caelifera (grasshoppers and allies) and Ensifera (crickets and katydids), they exhibit distinct morphological adaptations, including variations in antennal length and tympanal organ placement (Beutel et al. 2014, Song et al. 2020).

One of the superfamilies within Ensifera is Grylloidea, which contains six families: Gryllidae, Mogoplistidae, Oecanthidae, Phalangopsidae, Trigonidiidae, and Pteroplistidae (Cigliano et al. 2025). Oecanthidae was recently established as a family by Campos et al. (2022) as the sister group to Gryllidae and includes approximately 1,442 described species in 159 genera (Campos et al. 2022, Cigliano et al. 2025).

Oecanthidae crickets are typically found in vegetation such as bushes and trees. They range from apterous to macropterous forms and include species without stridulatory apparatus or tympanal organs. Diagnostic characters of this family are as follows: first and second tarsomeres dorsoventrally flattened on anterior and middle legs, with pulvilli; internal apical spurs on the hind tibiae three or more times longer than the external apical spurs; and ovipositor generally exhibiting projections, protuberances, or lateral serrations (Campos et al. 2022).

Four subfamilies are grouped within Oecanthidae: Podoscirtinae, Oecanthinae, Tafaliscinae, and Eucyrtinae (Cigliano et al. 2025). One tribe inside Tafaliscinae is Neometrypini, which is primarily characterized by the absence of acoustic communication resulting from the lack of tympanal organs and stridulatory apparatus. Additionally, members of the tribe may be apterous, macropterous, or fully winged, the latter condition featuring only longitudinal veins. They are exclusively distributed in South America and classified into six genera.

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Apterotrypa Gorochov, 2017 was previously considered a subgenus of *Cylindrogryllus* Saussure, 1878 (Gorochov 2017) but later elevated to genus rank by Campos and Souza-Dias (2021, see also Campos et al. 2022). Its first species described was *A. noeli* Gorochov, 2017 from Bolivia, and two additional species, *A. mitarakensis* Campos & Desutter-Grandcolas, 2020 and *A. guyanensis* Campos & Desutter-Grandcolas, 2020, were described from French Guiana (Campos and Desutter-Grandcolas 2020).

Crickets of the genus *Apterotrypa* inhabit bushes (Campos and Desutter-Grandcolas 2020), but little is known about their biology. These crickets are characterized by two distinctive traits: the absence of wings, which inspired the genus name, and the posterior margin of the pronotum covering the metanotum. They also lack both stridulatory apparatus and tympanal organs (Campos et al. 2022). Ecological and behavioral studies are currently not available for such an understudied genus despite its distinctive traits, such as the absence of wings and acoustic communication, which are essential characteristics for communication and reproductive behaviors in Grylloidea.

This study aims to describe three new species of *Apterotrypa*, representing the first records of the genus in Brazil and doubling its known species diversity. An identification key and a distribution map for the genus are also presented.

Material and methods

Studied material.—All specimens were collected during field expeditions in Brazil: Parque Nacional e Histórico do Monte Pascoal, Bahia; Parque Nacional do Iguaçu, Paraná and Pacoti, Ceará. The new species were compared with the described species of *Apterotrypa*: *A. noeli* Gorochov, *A. mitarakensis* Campos and Desutter-Grandcolas, and *A. guyanensis* Campos and Desutter-Grandcolas, using the original descriptions and illustrations (Gorochov 2017, Campos and Desutter-Grandcolas 2020).

Taxonomy.—The specimens were preserved individually in glass tubes containing 80% ethanol. Males were dissected to extract the phallic complex, and females were dissected to remove the copulatory papilla. The phallic complex was treated with an aqueous solution of 10% KOH for several hours to remove muscle tissue and clear the sclerites and membranes. After KOH treatment, the phallic complex was washed with water and acetic acid 10% solution to neutralize residual KOH and subsequently rewashed with water to remove acid excess. Genital nomenclature follows Desutter (1987), Desutter-Grandcolas (2003), and Campos and Desutter-Grandcolas (2020).

The structures were analyzed, compared, and described using a Leica EZ4 stereomicroscope. Photographs of external morphological structures were taken using a Leica MZ16 stereomicroscope equipped with a Leica MC170HD digital camera. Photographs of male and female genitalia were captured with a Canon Rebel T5i camera mounted on a Zeiss Stemi DV4 stereomicroscope. Genitalia were immersed in hand sanitizer gel for photography (Su 2016).

Images were taken at different focal planes and stacked using Helicon Focus 8.2. After processing, images were edited in Affinity Photo when necessary, and final plates and illustrations of male genitalia were prepared using Affinity Designer software.

Distribution data were compiled to produce a map using Quantum GIS 3.34.11 (QGIS), with type localities obtained from specimen labels and data available in the literature (Gorochov 2017, Campos and Desutter-Grandcolas 2020, Campos et al. 2022, Cigliano et al. 2025). The holotypes will be deposited at Museu Nacional – Universidade Federal do Rio de Janeiro (MNRJ), and the paratypes at Museu de Zoologia da Universidade de São Paulo (MZSP).

Abbreviations.—

General morphology:

I, II, III	anterior, median, posterior (legs, tarsomere)
DD	dorsal disc of pronotum
LL	lateral lobe of pronotum
FW	forewings
F	femur
T	tibia
iad, iam, iav	dorsal, median, and ventral apical spurs of hind tibia on inner side
oad, oam, oav	dorsal, median, and ventral apical spurs of hind tibia on outer side
TIII	subapical and apical spurs of hind tibia follow the indicated formula: internal/external

Male genitalia:

MLophi	medial lobe of pseudepiphallus
LLophi	lateral lobe of pseudepiphallus
m	membrane
PsP	pseudepiphallic paramere
vpEct	ventral projection of ectophallic invagination
EctAp	ectophallic apodeme
EctF	ectophallic fold
arc	ectophallic arc
End	endophallic sclerite
r	rami

Measurements:

HW	head width
IOD	interocular distance
PL	pronotum length
PW	pronotum width
LFIII	hind femur length
WFIII	hind femur width
LTIII	hind tibia length
LBIII	hind basitarsus length
OL	ovipositor length

Results

Systematics

Order Orthoptera Olivier, 1789
Superfamily Grylloidea Laicharting, 1781
Family Oecanthidae Blanchard, 1845
Subfamily Tafaliscinae Desutter–Grandcolas, 1988
Supertribe Paroecanthidi Gorochov, 1986
Tribe Neometrypini Desutter–Grandcolas, 1988

Genus *Apterotrypa* Gorochov, 2017

Type species.—*Apterotrypa noeli* Gorochov, 2017.

Emended diagnosis.—Wings absent; metanotum covered by the posterior margin of the pronotum; TI without tympanic organ; male genitalia: MLophi absent, LLophi triangular, inclined inward, inner margin membranous, apical portion curved upward; PsP apex bilobed; ventral projections of ectophallic invagination reduced; female: ovipositor apex triangular; female genitalia: posterior apex conical.

Apterotrypa assymmetrica **Tonon & Campos, sp. nov.**

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Figs 1–4, 11, Table 1

Type material.—**Holotype**: BRAZIL • ♂; Ceará, Pacoti; 15–18 March 2020; P.G.B. Souza-Dias, leg; MNRJ. **Paratypes**: BRAZIL • 1♂; same information as holotype; MZSP • 1♀; same information as holotype; MNRJ • 1♀; same information as holotype; MZSP.

Etymology.—Species named in reference to the notable asymmetry of the ectophallic fold of the male genitalia of this species in dorsal and ventral view.

Type locality.—Pacoti, Ceará, Brazil.

Diagnosis.—This species can be distinguished from other species of *Apterotrypa* by the following characteristics: two spots on the posterior margin of the pronotum; male supra-anal plate posterior margin with a small entrance on median region directed toward anterior region; subgenital plate with medial margin convex, dark brown. Male genitalia: membrane 1/3 the size of LLophi in dorsal view; ectophallic fold strongly asymmetrical in dorsal and ventral views; endophallic sclerite with horizontal lines throughout its structure.

Description.—Head: Occiput and vertex pubescent. Fastigium wider than long, pubescent (Fig. 2A, D). Ocelli absent (Fig. 2C). Frons smooth (Fig. 2C). Antennal scapes longer than wide in lateral view, pubescent. Genae smooth. Maxillary palps: article 3 slightly longer than articles 4 and 5, the latter almost equally sized; article 5 clavate. (Fig. 2E). Thorax: Pronotum longer than wide in dorsal view, pubescent (Fig. 2A, D). Dorsal disc of pronotum cephalic margin almost straight, caudal margin almost straight (Fig. 2A, D). Lateral lobe of pronotum ventro-cephalic angle rounded, ventrocaudal angle gradually ascending (Fig. 2E). Wings absent. Legs: Legs I and II pubescent. TI with three apical spurs, two inner equally sized, one outer longer than inner. TII with four apical spurs, two inner equally sized and two outer equally sized, longer than inner. FIII longer than TIII, pubescent. TIII subapical spurs formula: 4/5, two spines between each spur, most apical pair of subapical spurs with one spine between them, seven or nine spines above subapical spurs on inner and outer sides (Fig. 1). TIII apical spurs formula: 3/3; TIII inner apical spurs: iad > iam > iav; outer apical spurs: oam > oad > oav (Fig. 1). TIII spines and spurs with curved apex (Fig. 1). Basitarsus with four spines on outer side and one on inner side, distal spine longer than others, two apical spurs, one each side equally sized. Abdomen: Tergites pubescent (Fig. 2A). Cerci pubescent. Supra-anal plate posterior margin roundedly beveled on median region, pubescent (Fig. 2H).

Male. Posterior margin of pronotum covering metanotum. Metanotum with two macules on the posterior margin, globular structure on median region (Fig. 2G). Last abdominal tergite with posterior margin black, same as supra-anal plate (Fig. 2H). Subgenital plate longer than wide in ventral view, posterior margin straight (Fig. 2I).

Male genitalia: (Fig. 3A–D; Fig. 4A–C) Pseudepiphallus: pseudepiphallus sclerite almost straight in lateral view (Fig. 3C); medial region of anterior margin slightly concave, lateral margin curved upward in dorsal view. Lateral lobe of pseudepiphallus slightly inclined toward internal region in dorsal and ventral views (Fig. 3A, B), apex curved upward in lateral view (Fig. 3C), rounded in dorsal and ventral views; internal margin membranous, corresponding to 1/3 of sclerotized portion. Pseudepiphallic paramere reaching base of lateral lobe of pseudepiphallus in ventral view (Fig. 3B), posterior portion divided into two lobes, not exceeding the posterior margin of pseudepiphallic sclerite in dorsal and ventral views (Fig. 3B); apex of external lobe tapered and longer than posterior margin of the internal lobe in ventral view, slightly inclined toward ventral region in lateral view (Fig. 3C). Rami elongated, longer than pseudoepiphallic sclerite, slightly sclerotized (Fig. 3A, B). Ectophallic invagination: Ectophallic apodeme longer than lateral lobe of pseudepiphallus, straight and inclined outward in dorsal and ventral views (Fig. 3A, B); arc open; ventral projections of ectophallic invagination reduced, shorter than arc. Ectophallic folds asymmetrical in ventral view (Fig. 3B), anterior portion curved outward, diverging from endophallic sclerite. Endophallic sclerite: Elongated, dorsoventrally flattened, with horizontal lines across the structure, almost same length as ectophallic apodeme in dorsal and ventral views, sinuous (Fig. 3A, B); posterior margin unsclerotized, surpassing posterior margin of ectophallic fold; endophallic apodeme absent.

Female. Body larger than male. Metanotal structure below posterior margin of pronotum, similar to male (Fig. 2B–red arrow). Subgenital plate broader than long, with posterior medial portion convex and posterior margin rounded, pubescent (Fig. 2K). Supra-anal plate rounded on posterior margin, medial portion longer than lateral portion (Fig. 2J). Ovipositor curved upward in lateral view, margins slightly serrated near the apex, pointed (Fig. 2L, M). Female genitalia (Fig. 3E–G). Copulatory papilla cylindrical, longer than wide in ventral view (Fig. 2G). Distal margin rounded

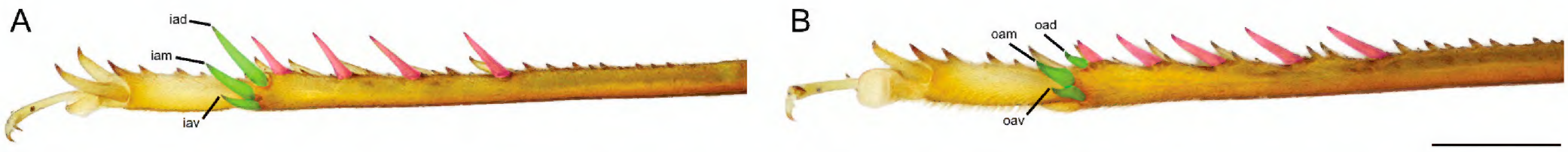

Fig. 1. *Apterotrypa assymmetrica* Tonon & Campos, **sp. nov.**, posterior tibia. **A.** Inner side; **B.** Outer side. Green, apical spurs; pink, subapical spurs. iad: inner apical spur dorsal, iam: inner apical spur median, iav: inner apical spur ventral, oad: outer apical spur dorsal, oam: outer apical spur median, oav: outer apical spur ventral. Scale bar: 1 mm.

Table 1. Measurements in mm of *Apterotrypa assymmetrica* Tonon & Campos, **sp. nov.**

	HW	IOD	PL	PW	LFIII	WFIII	LTIII	LBIII	OL
Male (n = 2)	1.8–1.9	1.1–1.2	2.5–2.6	1.9–2	5.7–6.2	1.8–1.9	4.5–5	1.1–1.3	–
μ	1.85	1.15	2.576	1.989	5.94	1.87	4.784	1.2	–
Female (n = 2)	2–2.1	1.1–1.2	2.9	2.2	6.6–7.5	2.3–2.4	5.4–5.9	1.1	4.9–5.5
μ	2.038	1.179	2.9	2.2	7.07	2.361	5.723	1.1	5.188

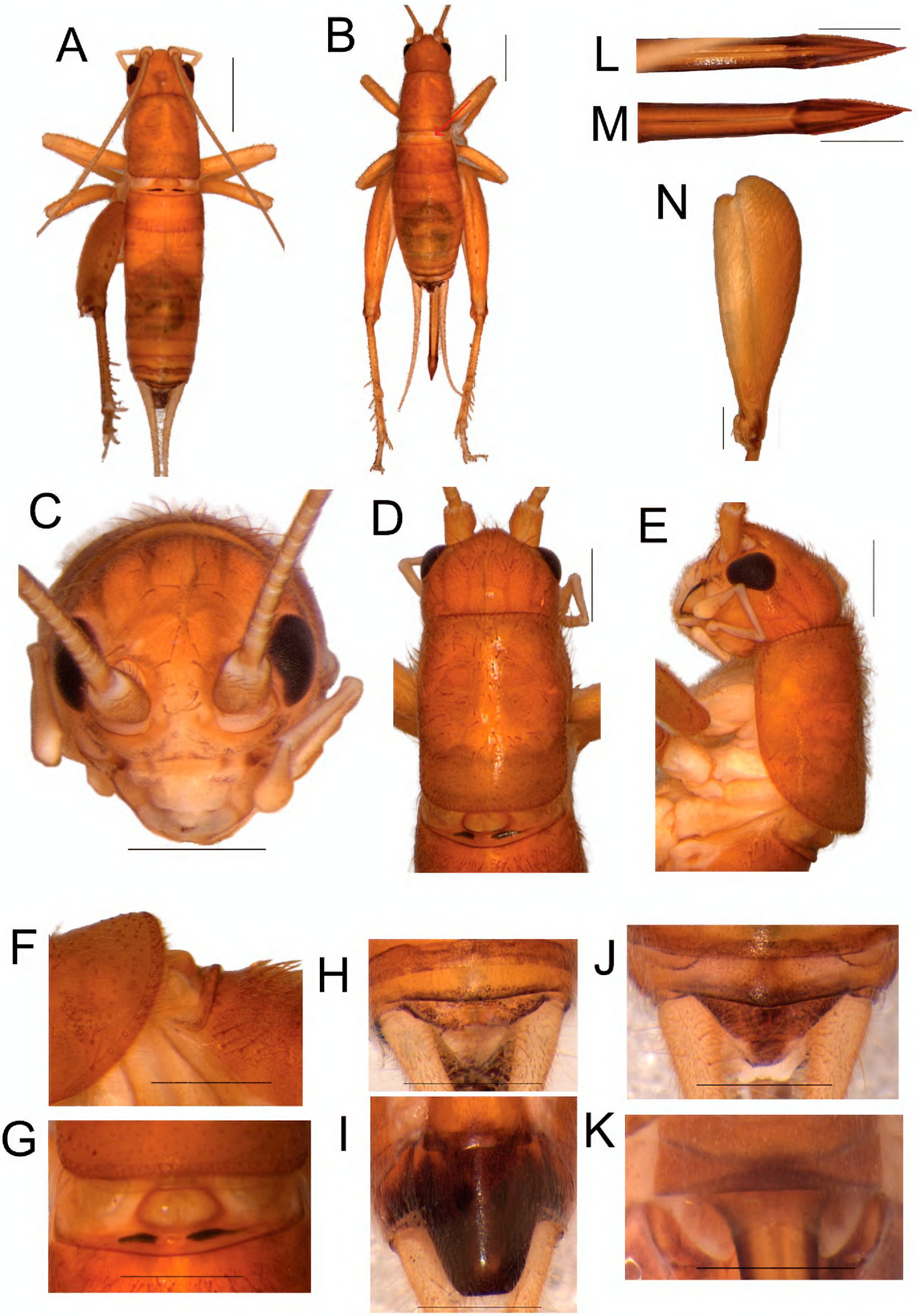

Fig. 2. *Apterotrypa assymmetrica* Tonon & Campos, **sp. nov. A.** Dorsal habitus, male; **B.** Dorsal habitus, female; **C.** Head, frontal view, male; **D.** Head, pronotum, and metanotum, dorsal view, male; **E.** Head, pronotum, and metanotum, lateral view, male; **F.** Metanotum, lateral view, male; **G.** Metanotum, dorsal view, male; **H.** Supra-anal plate, male; **I.** Subgenital plate, male; **J.** Supra-anal plate, female; **K.** Subgenital plate, female; **L.** Ovipositor, dorsal view; **M.** Ovipositor, ventral view; **N.** Hind femur, outer side. Scale bars: 2 mm (**A, B**); 1 mm (**C–N**).

in dorsal and ventral views, unsclerotized (Fig. 3E, G). Posterior margin nearly straight in dorsal view (Fig. 3E). Ventral face longer than dorsal face in lateral view (Fig. 2F). Aperture in ventral region D-shaped (Fig. 3G).

Coloration: Male and female with similar coloration (Fig. 2A, B). Occiput and vertex dark yellow, bristles dark yellow. Fastigium, frons, genae, antennal scapes, antennomeres, mandibles, clypeus, and labrum light yellow (Fig. 2C). Antennal scapes' bristles dark yellow, antennomeres light yellow. Ventral margin of labrum dark brown. Maxillary palps light yellow, apex of 5th segment whitish (Fig. 2C). Pronotum dark yellow, bristles brown. Lateral lobe of pronotum dark yellow (Fig. 2D, E). Two brown spots on posterior margin of male metanotum (Fig. 2G). Abdominal tergites dark yellow. Supra-anal plate yellowish with a posterior margin dark brown (Fig. 2H). Male subgenital plate brown, posterior margin dark brown (Fig. 2I). Female subgenital plate light yellow, bristles yellow (Fig. 2K). Cerci yellow. Ovipositor light yellow on inner side, margins and apex brown (Fig. 2L, M). Legs I and II with yellow bristles. FI and FII light yellow. TI and TII dark yellow. TIII dark yellow, bristles yellow; spur insertion light brown. Apex of TIII spurs brown, basal region yellowish. Basitarsus yellowish, bristles yellow (Fig. 1).

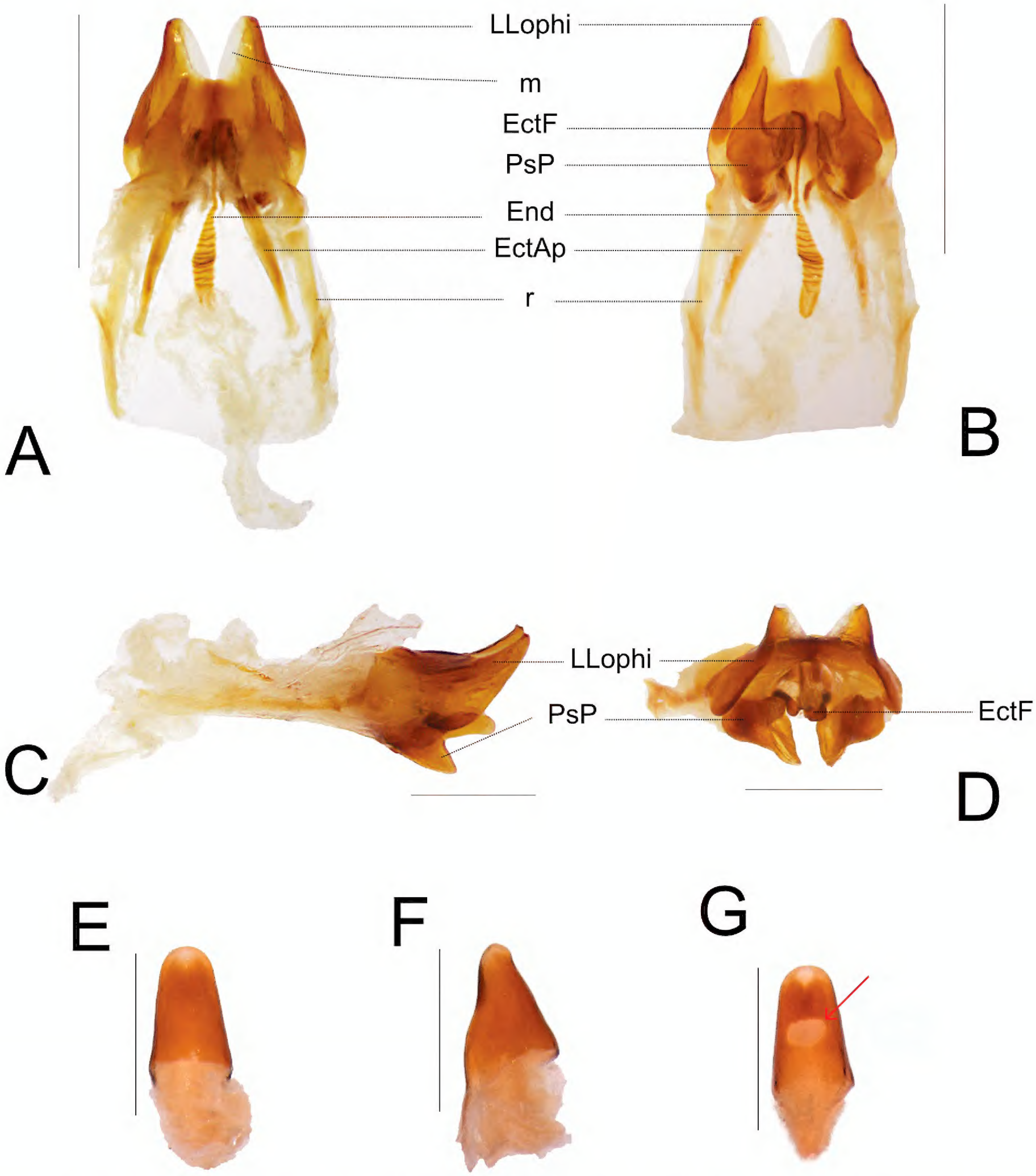

Fig. 3. *Apterotrypa assymmetrica* Tonon & Campos, **sp. nov.** Male genitalia: **A.** Dorsal view; **B.** Ventral view; **C.** Lateral view; **D.** Posterior view. Copulatory papilla: **E.** Dorsal view; **F.** Lateral view; **G.** Ventral view. Scale bars: 1 mm (**A–D**); 0.5 mm (**E–G**). Abbreviation see material and methods.

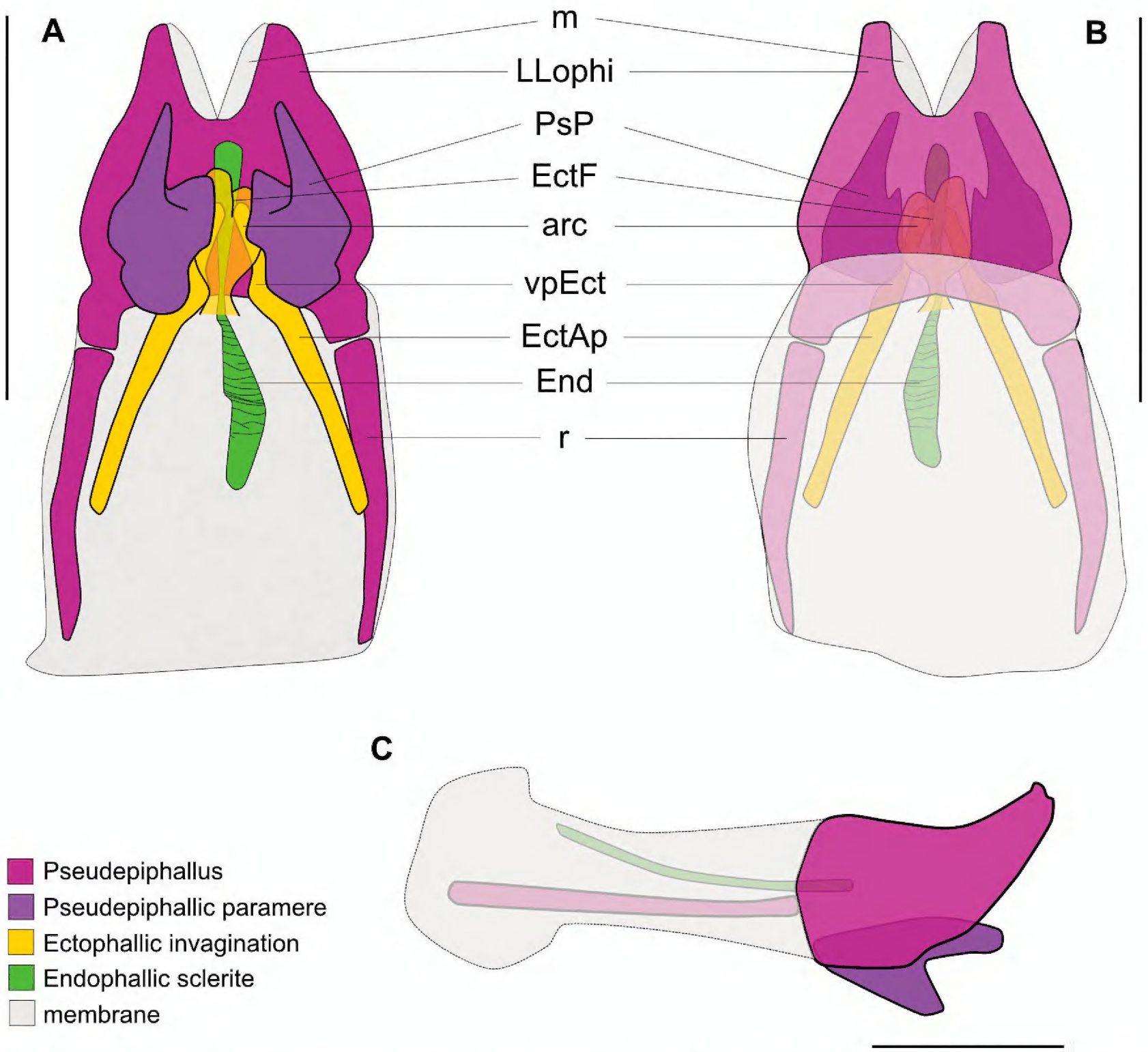

Fig. 4. *Apterotrypa assymmetrica* Tonon & Campos, **sp. nov.** Male genitalia: **A.** Dorsal view; **B.** Ventral view; **C.** Lateral view. Scale bars: 1 mm (**A–C**). Abbreviation: see material and methods.

Apterotrypa hepatica **Tonon & Campos, sp. nov.**

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Figs 5–7, 11, Table 2

Type material.—**Holotype:** BRAZIL • ♂; Bahia, Itamaraju; Parque Nacional e Histórico do Monte Pascoal; 08–11 March 2012; P.G.B. Souza-Dias et al. leg; MNRJ. **Paratypes**: BRAZIL • 1♀; same information as holotype; MNRJ.

Etymology.—Species name in reference to the similarity of the lateral photograph of the male's genitalia with an illustration of a human liver.

Type locality.—Itamaraju, Bahia, Brazil.

Diagnosis.—This species is separated from other species of *Apterotrypa* by the following characteristics: single macula on posterior margin of pronotum, lateral margins darker; male supra-anal plate elongated medially, weakly sclerotized; subgenital plate brown, anterior margin medially less sclerotized. Male genitalia: m 2/3 the size of LLophi in dorsal view; ectophallic fold asymmetrical in posterior view, anterior portion converging toward inner part; female genitalia: copulatory papilla unsclerotized in apical portion.

Description.—Head: Occiput smooth. Vertex pubescent. Fastigium as long as wide, with bristles (Fig. 5D). Ocelli absent. Frons smooth (Fig. 5C). Antennal scapes longer than wide in lateral view, pubescent. Genae smooth. Maxillary palps: article 3 almost equally sized than article 4, larger than article 5; article 5 claviform, pubescent (Fig. 5C). Thorax: Pronotum longer than wide in dorsal view, with bristles (Fig. 5D). Dorsal disc of pronotum cephalic margin almost straight, caudal margin rounded (Fig. 5D). Lateral lobe of pronotum ventro-cephalic angle slightly rounded, ventro-caudal angle gradually ascending (Fig. 5E). Wings absent. Legs: Legs I and II with

Table 2. Measurements in mm of *Apterotrypa hepatica* Tonon & Campos, **sp. nov.**

	HW	IOD	PL	PW	LFIII	WFIII	LTIII	LBIII	OL
Male (n = 1)	1.9	1.2	2.7	1.9	6	1.9	4.8	1.1	–
Female (n = 1)	2.1	1.2	2.9	2.6	8.1	2.6	7.3	1.2	8.1

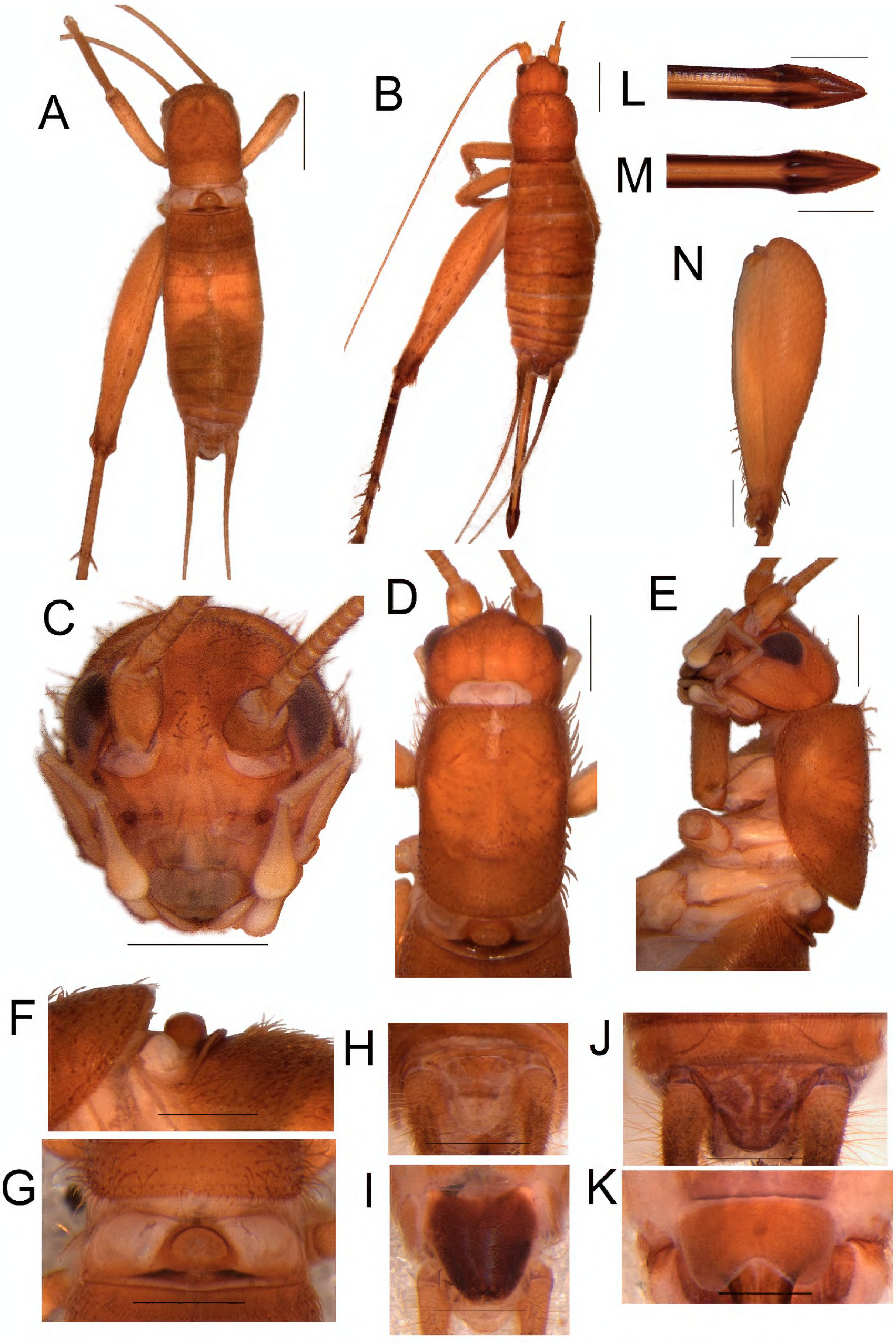

Fig. 5. *Apterotrypa hepatica* Tonon & Campos, **sp. nov. A.** Dorsal habitus, male; **B.** Dorsal habitus, female; **C.** Head, frontal view, male; **D.** Head, pronotum, and metanotum, dorsal view, male; **E.** Head, pronotum, and metanotum, lateral view, male; **F.** Metanotum, lateral view, male; **G.** Metanotum, dorsal view, male; **H.** Supra-anal plate, male; **I.** Subgenital plate, male; **J.** Supra-anal plate, female; **K.** Subgenital plate, female; **L.** Ovipositor, dorsal view; **M.** Ovipositor, ventral view; **N.** Hind femur, outer side. Scale bars: 2 mm (**A, B**); 1 mm (**C–N**).

bristles. TI with three apical spurs: two internal spurs equally sized, one external spur longer than the internal ones. TII with four apical spurs: two internal equally sized and two external equally sized, external ones longer than internal ones. FIII longer than TIII, with bristles. TIII subapical spurs formula: 4/5, one to three spines between each pair of subapical spurs, and eight to nine spines above basal subapical spurs on both internal and external sides. TIII apical spurs formula: 3/3, longer on inner side; TIII inner apical spurs: iad > iam > iav; outer apical spurs: oam > oad > oav; oav and oad almost equally sized. TIII apical and subapical spurs with curved apex. Basitarsus with three spines on outer side and one on inner side; two apical spurs, one each side equally sized. Abdomen: Tergites pubescent (Fig. 5A). Cerci with bristles. Supra-anal plate posterior margin rounded and medially elongated (Fig. 5H).

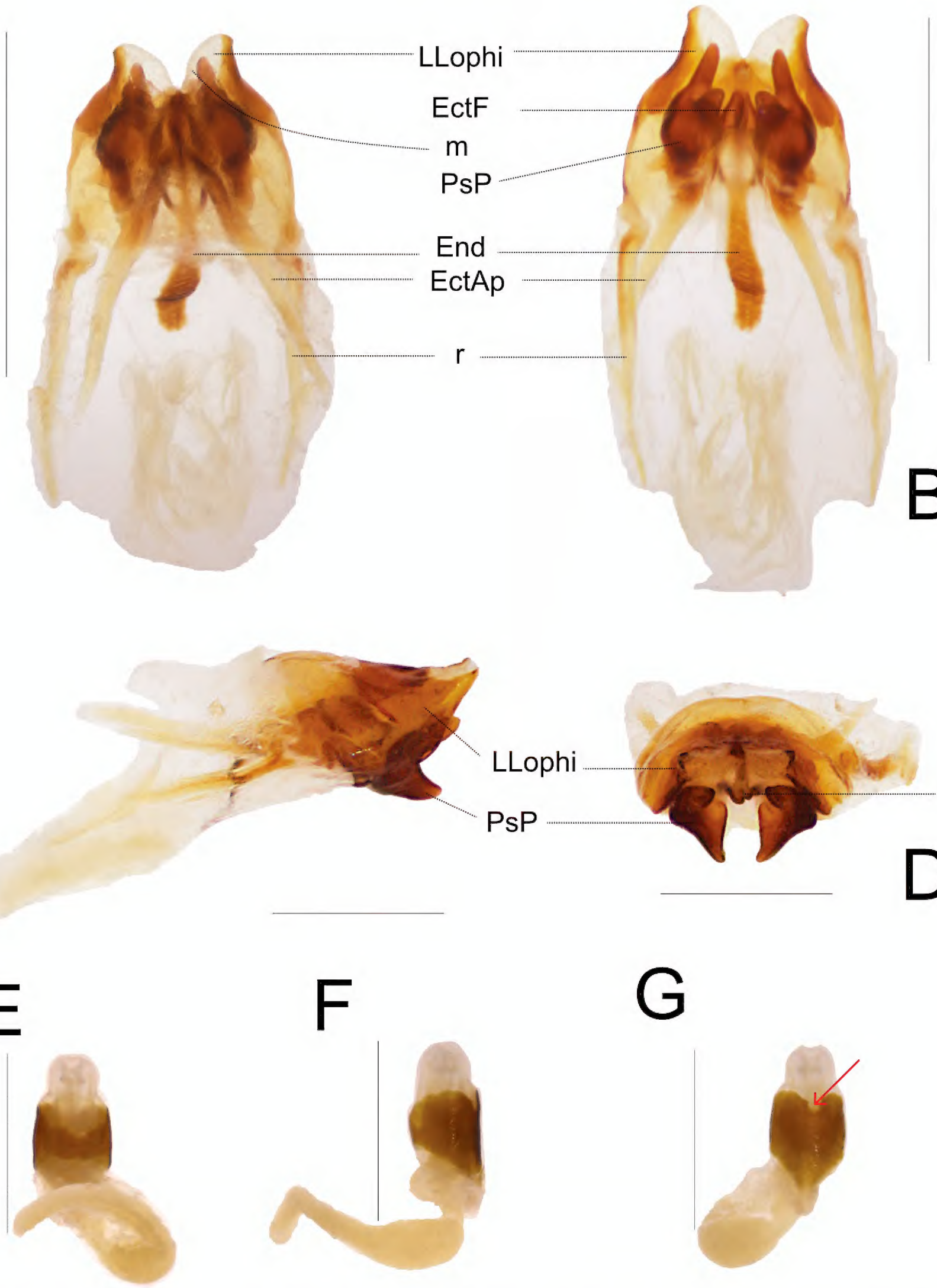

Fig. 6. *Apterotrypa hepatica* Tonon & Campos, **sp. nov.** Male genitalia: **A.** Dorsal view; **B.** Ventral view; **C.** Lateral view; **D.** Posterior view. Copulatory papilla: **E.** Dorsal view; **F.** Lateral view; **G.** Ventral view. Scale bars: 1 mm (**A–D**); 0.5 mm (**E–G**). Abbreviation see material and methods.

Male. Posterior margin of pronotum covering metanotum. Metanotum with a globular structure on median region, macula on posterior margin, margins darker (Fig. 5G). Subgenital plate longer than wide in ventral view, anterior part less sclerotized, medially "U" shaped, posterior margin almost straight (Fig. 5I).

Male genitalia: (Fig. 6A–D; Fig. 7A–C) Pseudepiphallus: Pseudepiphallic sclerite anterior portion convex in lateral view (Fig. 6C); anterior margin rounded in medial region. Lateral lobe of pseudepiphallus inclined inward in dorsal and ventral views (Fig. 6A, B); apex slightly curved upwards in lateral view (Fig. 6C), rounded in dorsal and ventral views (Fig. 6A, B); internal margin membranous, 2/3 the size of sclerotized portion. Pseudepiphallic paramere reaching half of lateral lobe of pseudepiphallus in ventral view (Fig. 6B), posterior portion divided into two lobes extending beyond posterior margin of pseudepiphallic sclerite in dorsal and ventral views (Fig. 6A, B); apex of external lobe longer than posterior margin of internal lobe in ventral view (Fig. 6B), slightly inclined ventrally in lateral view (Fig. 6C). Rami elongated, longer than pseudepiphallic sclerite, weakly sclerotized at anterior portion. Ectophallic invagination: Ectophallic apodeme longer than lateral lobe of pseudepiphallus, straight and inclined outward in dorsal and ventral views (Fig. 6A, B); arc open, posterior portion directed distally; ectophallic ventral projections reduced, shorter than arc. Ectophallic folds asymmetrical in posterior view (Fig. 6D), anterior portion curved inward, converging toward the endophallic sclerite. Endophallic sclerite: Elongated, dorsoventrally flattened, diagonal lines throughout the structure, smaller than the ectophallic apodeme in dorsal and ventral views (Fig. 6A, B), sinuous in lateral view (Fig. 6C), strongly curved ventrally in lateral view (Fig. 6C); posterior margin unsclerotized, extending beyond posterior margin of the ectophallic fold; endophallic apodeme absent.

Female. Body larger than male. Subgenital plate wider than long, posterior portion convex, margin triangular (Fig. 5K). Supra-anal plate posterior margin rounded, longer in medial portion, darker than male (Fig. 5I). Ovipositor curved upward in lateral view, serrated margins near the apex, pointed (Fig. 5L, M). Female genitalia: (Fig. 6E–G) Copulatory papilla cylindrical, posterior region less sclerotized, 1/3 the length of the sclerotized region in dorsal view (Fig. 6E). Medial portion of the sclerotized region invaginated, forming a "U" shape in ventral view, highlighted in figure (Fig. 6G), straight in lateral view (Fig. 6F). Ventral face longer than dorsal in lateral view (Fig. 6F).

Coloration: Male slightly lighter than female (Fig. 5A, B). Occiput and vertex dark yellow, dark yellow bristles; fastigium light yellow (Fig. 5D). Frons whitish-yellow. Genas light yellow. Antennal scapes and antennomeres light yellow, bristle dark

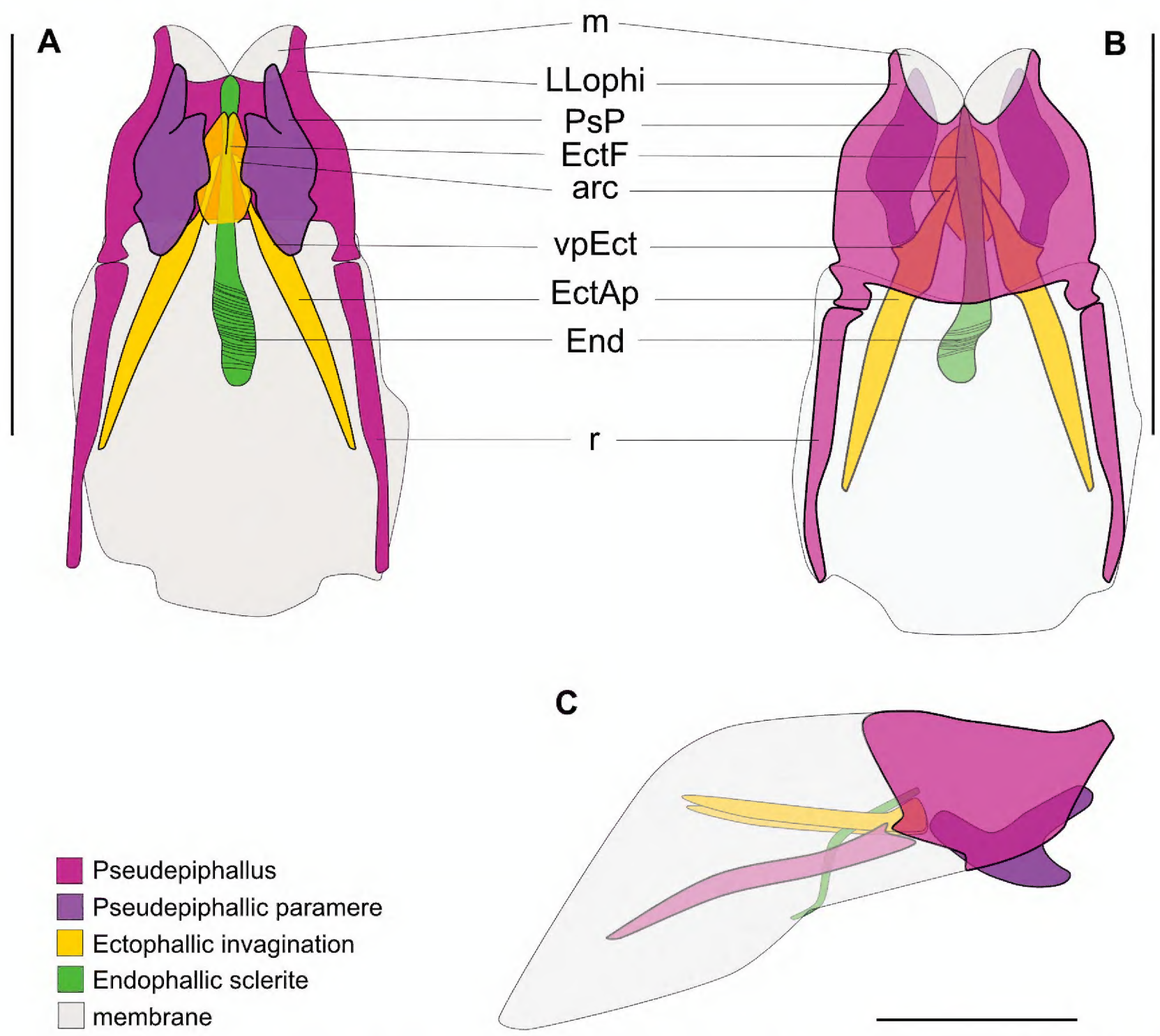

Fig. 7. *Apterotrypa hepatica* Tonon & Campos, **sp. nov.** Male genitalia: **A.** Dorsal view; **B.** Ventral view; **C.** Lateral view. Scale bars: 1 mm (**A–C**). Abbreviation see material and methods.

yellow (Fig. 5C). Clypeus and labrum light yellow (Fig. 5C). Maxillary palps yellow, apex of the fifth article white (Fig. 5C). Pronotum dark yellow in posterior portion, light yellow in medial and anterior portions, with dark yellow bristle (Fig. 5D). Lateral lobe of pronotum dark yellow (Fig. 5E). Metanotum medial region brown, lateral margins darker than medial region (Fig. 5G). Abdominal tergites dark yellow. Supra-anal plate dark yellow on anterior margin, light yellow to whitish on posterior margin (Fig. 5H). Subgenital plate brown, anterior margin translucent (Fig. 5I). Female subgenital plate pale yellow (Fig. 5K). Cerci yellow. Ovipositor internal margin light yellow, external margins and anterior portion dark brown, apex brown (Fig. 5L, M). Legs I and II bristles yellow. FI and FII light yellow. TI and TII light yellow. TIII light yellow, bristles yellow, spur insertion region light brown. Female TIII basal portion brown, lightening toward apex. TIII spurs and spines apex brown. Basitarsus light yellow, bristles yellow.

Apterotrypa endolongata **Tonon & Campos, sp. nov.**

https://zoobank.org/D32C4E02-970D-412C-AB4A-1EF3B90FD913

Figs 8–11, Table 3

Type material.—**Holotype:** BRAZIL • ♂; Santa Catarina, Corupá; RPPN Emílio Batistella; 05–06 December 2011; P.G.B. Souza-Dias, leg; MNRJ. **Paratypes**: BRAZIL • 1♂; same information as holotype; MZSP • 1♀; same information as holotype; MNRJ.

Etymology.—Species name in reference to the elongated endophallic sclerite in the male genitalia.

Type locality.—Corupá, Santa Catarina, Brazil.

Diagnosis.—This species is separated from other species of *Apterotrypa* by the following characteristics: posterior margin of pronotum with two lines; supra-anal plate elongated medially, small projection on posterior margin; subgenital plate dark yellow; m half the size of LLophi; PsP reaches apex of LLophi; ectophallic fold posterior margin extending beyond posterior margin of pseudepiphallic sclerite in ventral view.

Description.—Head: Occiput smooth. Vertex pubescent. Fastigium wider than long, with bristles (Fig. 8D). Ocelli absent. Frons pubescent (Fig. 8C). Antennal scapes longer than wide in lateral view, pubescent. Genae smooth. Maxillary palps: article 3 the longest; article 4 and 5 almost equally sized; article 5 strongly clavate, with bristles (Fig. 8C). Thorax: Pronotum longer than wide in dorsal view, covered by bristles. Dorsal disc of pronotum cephalic margin almost straight; caudal margin almost straight (Fig. 8A, D). Lateral lobe of pronotum ventro-cephalic angle slightly curved; ventro-caudal angle slightly ascending (Fig. 8E). Wings absent. Legs: Legs I and II with bristles. TI with three apical spurs: two inner spurs equally sized and one outer spur longer than internal ones. TII with four apical spurs: two internal spurs equally sized and two external spurs equally sized, external spurs longer than internal ones. FIII longer than TIII, with bristles. TIII subapical spurs formula: 4/5, one to three spines between each pair of subapical spurs; six to eight spines above basal subapical spurs on both sides. TIII apical spurs formula: 3/3, internal ones longer. TIII inner apical spurs: iad > iam > iav; outer apical spurs: oam > oad > oav, oav and oad almost equally sized. TIII apical and subapical spurs with curved apex. Basitarsus with four spines on outer side and one on inner side; two apical spurs, one each side equally sized. Abdomen: Tergites pubescent (Fig. 8A). Cerci pubescent. Supra-anal plate pubescent, medially elongated, posterior margin extended (Fig. 8H).

Male. Posterior margin of pronotum covering metanotum. Metanotum with a globular structure in medial region, two lines almost meeting medially on posterior margin (Fig. 9G). Subgenital plate longer than wide, posterior margin nearly straight, convex in lateral view (Fig. 9I).

Male genitalia: (Fig. 9A–D; Fig. 10A–C) Pseudepiphallus: Pseudepiphallic sclerite nearly straight in lateral view (Fig. 9C); anterior margin concave on medial region. Lateral lobe of pseudepiphallus inclined inward in dorsal and ventral views (Fig. 9A, B), apex slightly curved dorsally in lateral view (Fig. 9C), rounded in dorsal and ventral views (Fig. 9A, B); internal margin membranous, 1/3 the size of sclerotized portion. Pseudepiphallic paramere apex reaches margin of lateral lobe of pseudepiphallus in ventral view (Fig. 9B), posterior portion divided into two lobes, extending beyond posterior margin of pseudepiphallic sclerite in dorsal and ventral views (Fig. 9A, B); apex of external lobe longer than apex of internal lobe in ventral view (Fig. 9B), slightly inclined ventrally in lateral view (Fig. 9C). Rami elongated, longer than pseudepiphallic sclerite, less sclerotized in anterior portion. Ectophallic invagination: Ectophallic apodeme slightly longer than lateral lobe of pseudepiphallus, straight and inclined outward in dorsal and ventral views (Fig. 9A, B); arc open, posterior portion directed distally; ventral projections of ectophallic invagination reduced, shorter than the arc. Ectophallic fold asymmetrical in ventral view (Fig. 9B), anterior portion slightly curved, diverging from endophallic sclerite. Endophallic sclerite: Elongated, dorsoventrally flattened, with diagonal lines throughout the structure, equal length to ectophallic apodeme in ventral view (Fig. 9B); anterior portion curved ventrally in lateral view (Fig. 9C); posterior margin unsclerotized, extending beyond posterior margin of pseudepiphallic sclerite in ventral view (Fig. 9B); endophallic apodeme absent.

Female. Body larger than male. Metanotal structure below posterior margin of pronotum, similar to male (Fig. 8B–red arrow). Subgenital plate wider than long, posterior portion slightly convex, posterior margin slightly curved inwards, pubescent (Fig. 8K). Supra-anal plate similar to male, posterior portion rounded, longer than wide in ventral view (Fig. 8J). Ovipositor curved upward in lateral view, margins serrated near the apex, pointed (Fig. 8L, M). Female genitalia: (Fig. 9E–G) Copulatory papilla cylindrical, longer than wide in ventral view (Fig. 9G). Distal margin rounded in

Table 3. Measurements in mm of *Apterotrypa endolongata* Tonon & Campos, **sp. nov.**

	HW	IOD	PL	PW	LFIII	WFIII	LTIII	LBIII	OL
Male (n = 2)	1.7–1.8	0.9–1	2.4–2.5	1.8–1.9	5.2–5.3	1.7–1.8	3.9–4.1	0.8–0.9	–
μ	1.722	0.936	2.483	1.822	5.286	1.753	4.071	0.88	–
Female (n = 1)	1.8	1	2.8	2	6	1.9	4.5	1	5

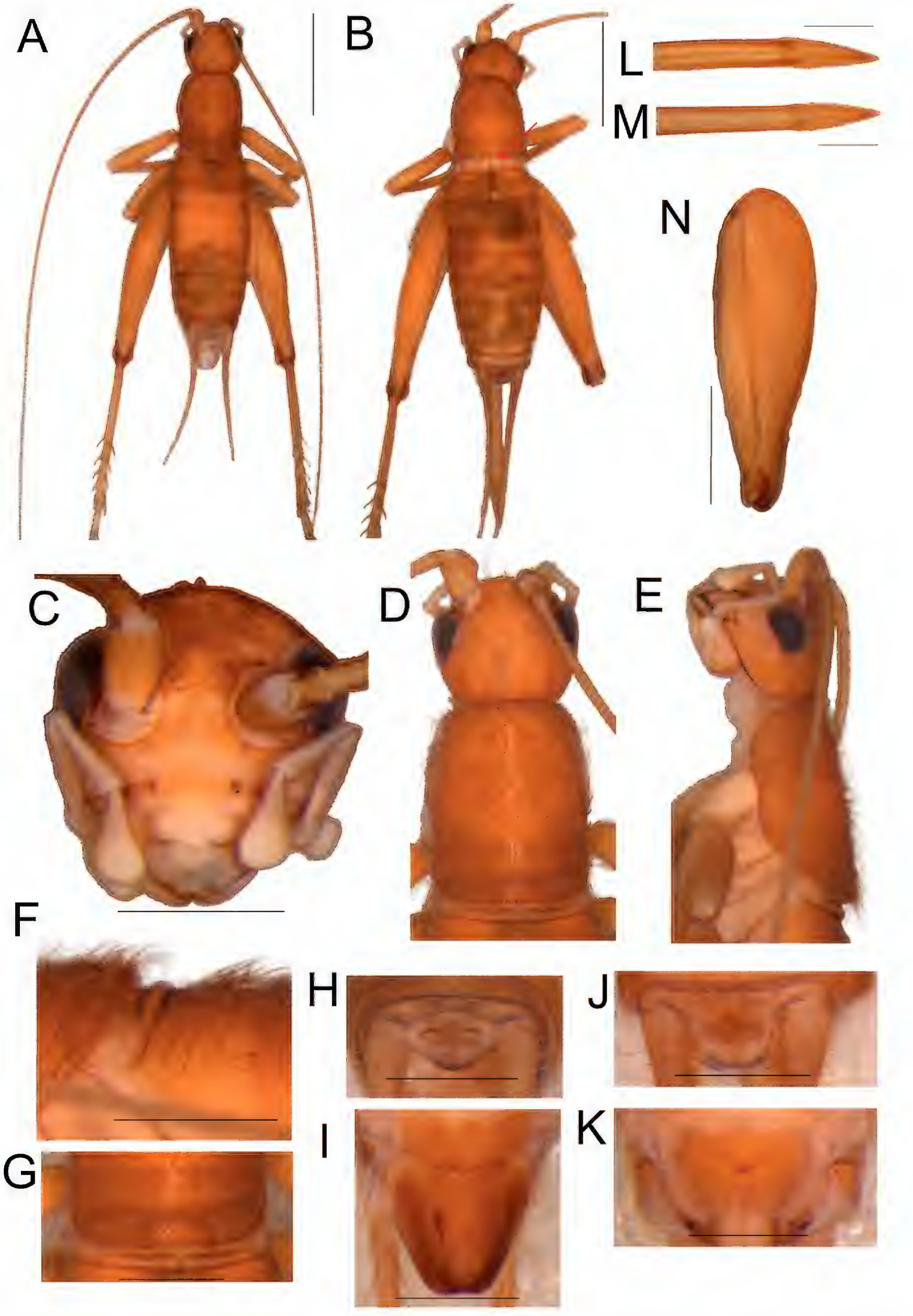

Fig. 8. *Apterotrypa endolongata* Tonon & Campos, **sp. nov. A.** Dorsal habitus, male; **B.** Dorsal habitus, female; **C.** Head, frontal view, male; **D.** Head, pronotum, and metanotum, dorsal view, male; **E.** Head, pronotum, and metanotum, lateral view, male; **F.** Metanotum, lateral view, male; **G.** Metanotum, dorsal view, male; **H.** Supra-anal plate, male; **I.** Subgenital plate, male; **J.** Supra-anal plate, female; **K.** Subgenital plate, female; **L.** Ovipositor, dorsal view; **M.** Ovipositor, ventral view; **N.** Hind femur, outer side. Scale bars: 2 mm (**A, B**); 1 mm (**C–N**).

dorsal and ventral views, less sclerotized (Fig. 9E, G). Medial portion of posterior margin less sclerotized in dorsal view (Fig. 9E). Ventral face longer than dorsal face in lateral view (Fig. 9F). Opening at ventral region D-shaped (Fig. 9G).

Coloration: Male coloration similar to female (Fig. 8A, B). Occiput and vertex dark yellow, bristles dark yellow; fastigium light yellow (Fig. 8D). Frons whitish-yellow. Genae yellowish. Antennal scapes and antennomeres light yellow, bristles dark yellow. Mandibles yellowish. Clypeus and labrum yellowish (Fig. 8C). Maxillary palps articles white. Pronotum light yellow, bristles dark yellow (Fig. 8A, D). Lateral lobe of pronotum light yellow (Fig. 8E). Posterior margin of metanotum with two grayish streaks (Fig. 8G). Abdominal tergites light yellow (Fig. 8A, B). Supra-anal plate light yellow, posterior margin black (Fig. 8H). Subgenital plate anterior portion light yellow, posterior portion dark yellow (Fig. 8I). Female subgenital plate light yellow (Fig. 8K). Cerci yellowish. Ovipositor with internal margin yellowish, lateral margins and distal portion light yellow (Fig. 8L, M). Legs I and II bristles yellow. FI and FII light yellow. TI and TII light yellow. TIII light yellow, bristles yellow. Spines and spurs light yellow, margins darker yellow.

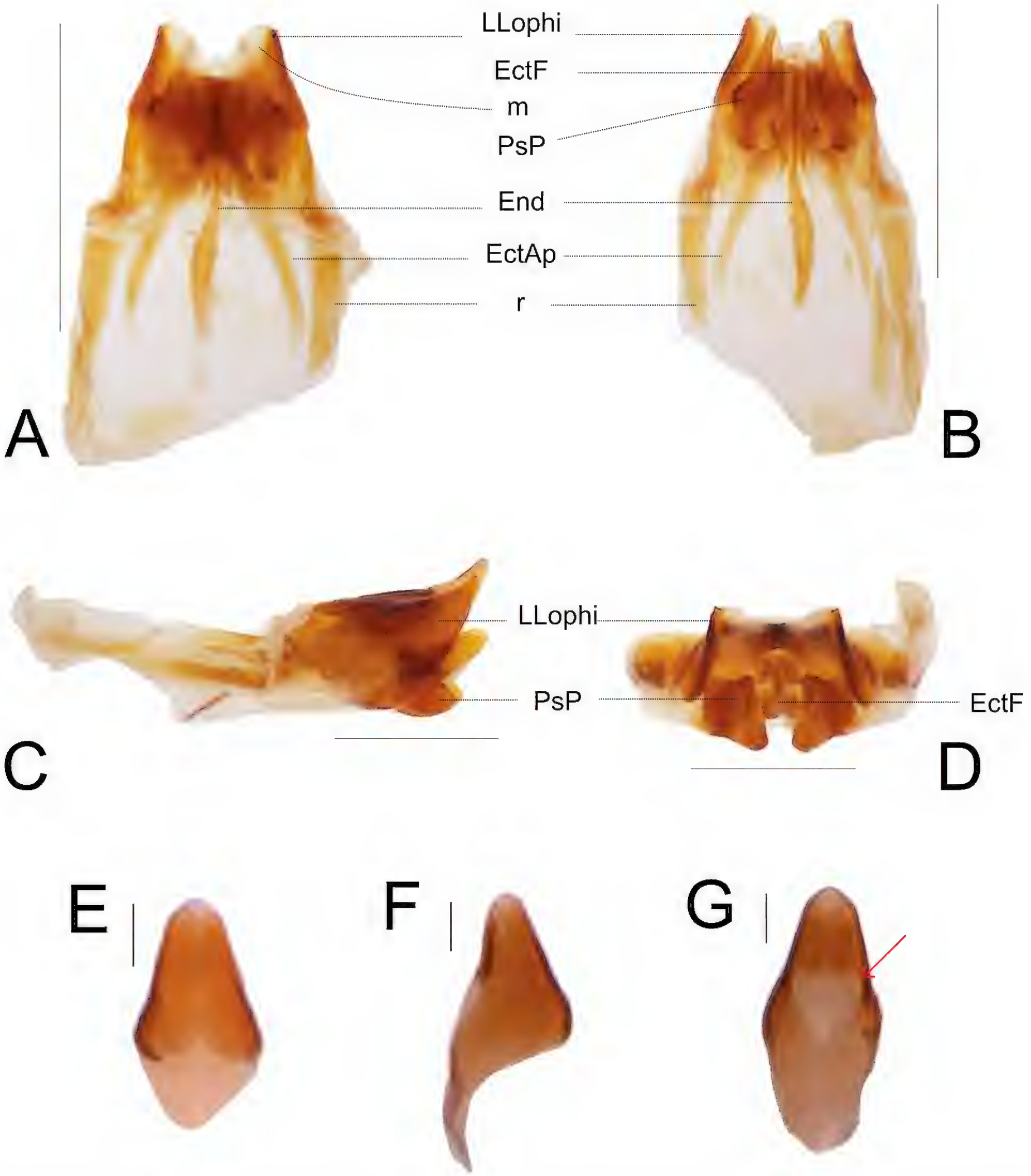

Fig. 9. *Apterotrypa endolongata* Tonon & Campos, **sp. nov.** Male genitalia: **A.** Dorsal view; **B.** Ventral view; **C.** Lateral view; **D.** Posterior view. Copulatory papilla: **E.** Dorsal view; **F.** Lateral view; **G.** Ventral view. Scale bars: 1 mm (**A–D**); 0.5 mm (**E–G**). Abbreviation see material and methods.

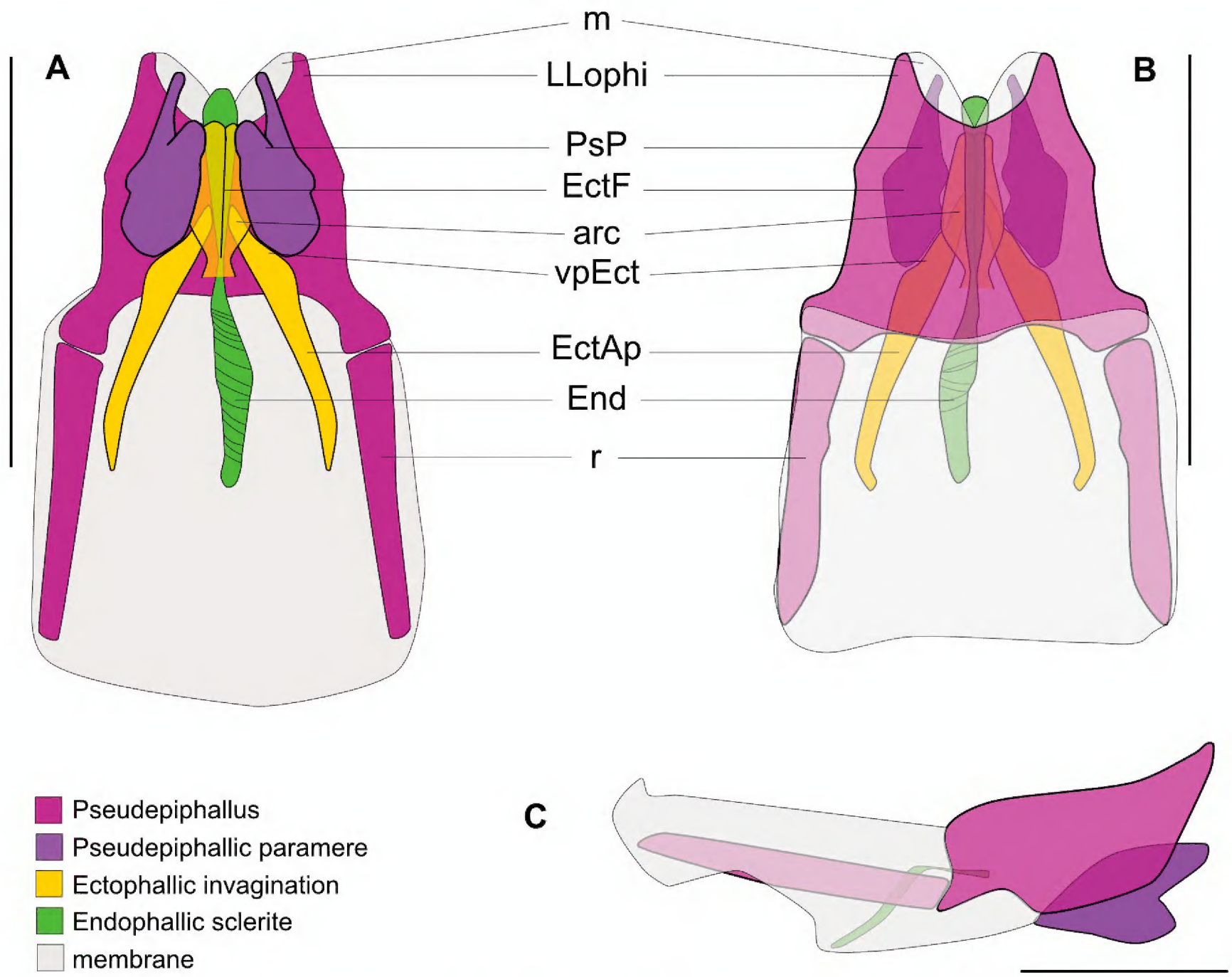

Fig. 10. *Apterotrypa endolongata* Tonon & Campos, **sp. nov.** Male genitalia: **A.** Dorsal view; **B.** Ventral view; **C.** Lateral view. Scale bars: 1 mm (**A–C**). Abbreviation see material and methods.

Identification Key for *Apterotrypa* Gorochov, 2017 Species (adapted from Campos and Desutter-Grandcolas 2020)

1 Ocelli present; general body coloration dark brown; male last abdominal tergite medially constricted, resembling the supra -anal plate; male subgenital plate light-colored; male genitalia: LLophi with bristles on inner margin; endophallic apodeme present; copulatory papilla: dorsal and ventral faces almost the same size ..... *A. mitarakensis* **Campos & Desutter-Grandcolas, 2020**

– Ocelli absent; general body coloration dark brown or light yellow; male last abdominal tergite not differentiated; male subgenital plate light or dark; male genitalia: LLophi without bristles on inner margin; endophallic apodeme present or absent; copulatory papilla: dorsal and ventral faces of different sizes **2**

2 Body coloration dark brown; male subgenital plate light; TIII with a well-defined dark brown stripe in proximal region; male genitalia: endophallic sclerite short, smaller than ectophallic apodemes; copulatory papilla: dorsal face longer than ventral ..... *A. guyanensis* **Campos & Desutter-Grandcolas, 2020**

– Body coloration light to dark yellow; male subgenital plate light or dark; TIII without a dark brown stripe in the proximal region; male genitalia: endophallic sclerite long, same size as ectophallic apodemes; copulatory papilla: dorsal and ventral faces with different size proportions **3**

3 Body coloration dark yellow; antennomeres with dark brown bands; male supra-anal plate elongated with a triangular posterior portion and rounded apex; male genitalia: ectophallic fold symmetrical; endophallic sclerite with sclerotized posterior portion not exceeding the ectophallic fold in ventral view; ectophallic apodemes same size as rami ..... *A. noeli* **Gorochov, 2017**

– Body coloration light yellow; antennomeres light yellow without dark bands; male supra -anal plate not as above; male genitalia: ectophallic fold asymmetrical; endophallic sclerite with a desclerotized posterior portion exceeding the ectophallic fold in ventral view; ectophallic apodemes shorter than rami 4

4 Male subgenital plate dark, anterior margin medially less sclerotized (Fig. 5I); metanotal structure absent in females; macula on the posterior margin of the metanotum with darker edges (Fig. 5G); supra-anal plate elongated medially, less sclerotized (Fig. 5H); male genitalia: ectophallic fold anterior portion converging toward the endophallic sclerite in dorsal and ventral views (Fig. 6A, B); copulatory papilla desclerotized in apical portion (Fig. 6E–G) ..... *Apterotrypa hepatica* **Tonon & Campos, sp. nov.**

– Male subgenital plate light or dark, anterior margin with similar color to the rest of structure; metanotal structure present in females; macula on posterior margin of the metanotum with a different pattern; male supra-anal plate with a black rounded margin; male genitalia: ectophallic fold with the anterior portion diverging from the endophallic sclerite in dorsal and ventral views (Fig. 3A, B; Fig. 9A, B); copulatory papilla with a D-shaped opening in ventral view (Fig. 3G, Fig. 9G) **5**

5 Metanotum with two transverse maculae on posterior margin (Fig. 2G); male subgenital plate dark (Fig. 2I); male supra-anal plate posterior margin with a small entrance on median region directed toward anterior region (Fig. 2H); male genitalia: endophallic sclerite with a posterior

portion not exceeding the pseudepiphallus sclerite in dorsal and ventral views (Fig. 3A, B); LLophi with 1/3 membranous portion in dorsal and ventral views (Fig. 3A, B); PsP external lobe apex not exceeding the posterior portion of the pseudepiphallus sclerite in dorsal view (Fig. 3A); ectophallic fold strongly asymmetrical in dorsal and ventral views (Fig. 3A, B) .....*Apterotrypa assymmetrica* **Tonon & Campos, sp. nov.**

– Metanotum with two transverse lines on posterior margin (Fig. 8G); male subgenital plate light (Fig. 8I); male supra-anal plate slightly elongated medially, small projection on the posterior margin (Fig. 8H); male genitalia: endophallic sclerite with posterior portion exceeding the pseudepiphallus sclerite in dorsal and ventral views (Fig. 9A, B); LLophi with half membranous portion in dorsal and ventral views (Fig. 9A, B); PsP external lobe apex exceeding the posterior portion of the pseudepiphallus sclerite in dorsal view (Fig. 9A); ectophallic fold slightly asymmetrical in posterior view (Fig. 9D) .... *Apterotrypa endolongata* **Tonon & Campos, sp. nov.**

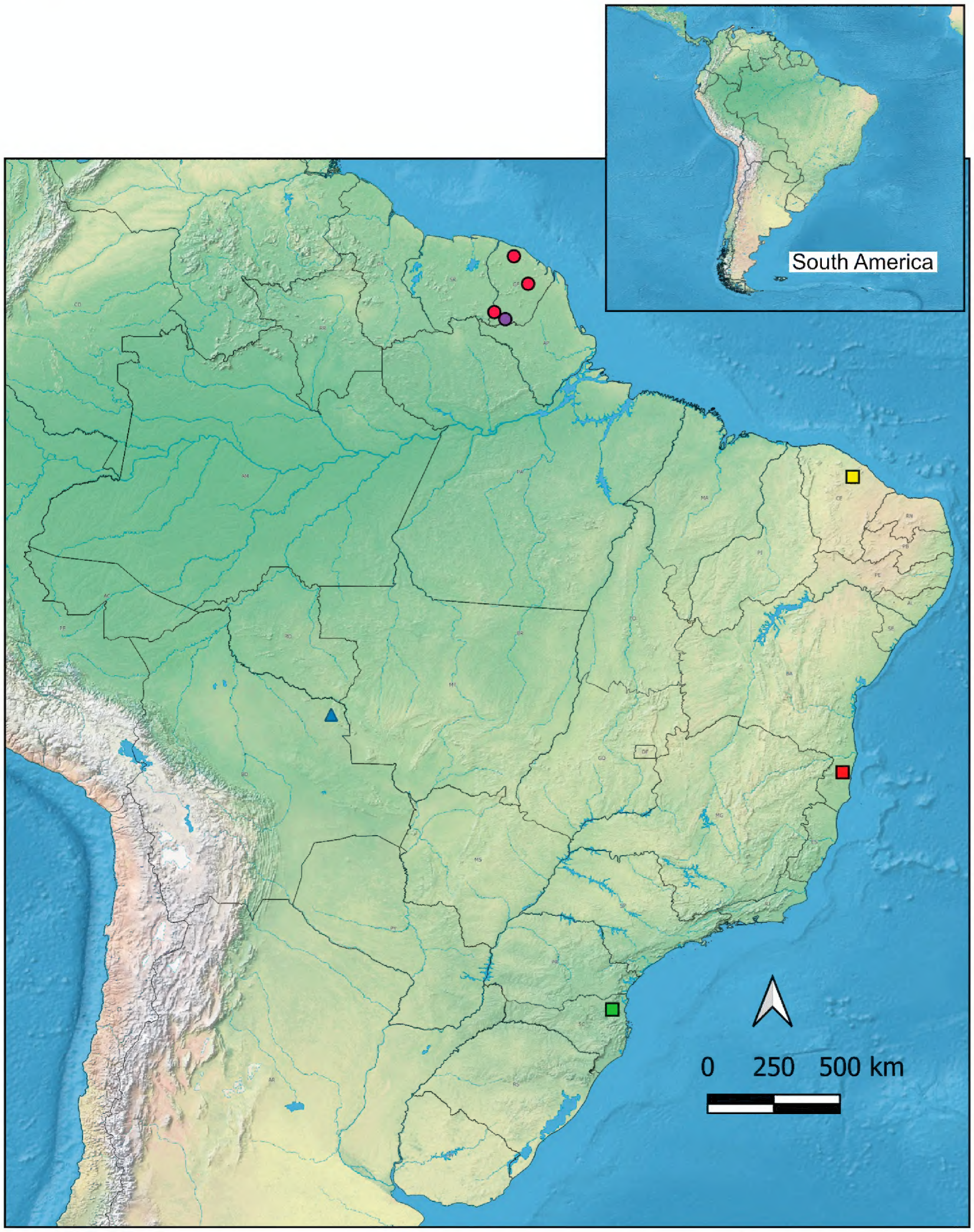

Fig. 11. Distribution map of the localities of *Apterotrypa* species.

Discussion

Three new species of the genus *Apterotrypa* are described in this study, doubling the total number of known species in the genus (Cigliano et al. 2025). These crickets are recorded exclusively in the neotropical region (Fig. 11): *A. noeli* in Bolivia; *A. mitarakensis* and *A. guyanensis* in French Guiana; and *Apterotrypa assymmetrica* Tonon & Campos, **sp. nov.**, *Apterotrypa hepatica* Tonon & Campos, **sp. nov.**, and *Apterotrypa endolongata* Tonon & Campos, **sp. nov.** in Brazil. It is likely that more species remain to be discovered; however, representatives of this genus are difficult to collect due to the absence of acoustic communication and their habit of living in bushes and trees (Campos and Desutter-Grandcolas 2020).

Adult crickets generally have two pairs of wings that may be fully developed or reduced, while some species are apterous. Although less common, other apterous and silent species have been described in the closely related genus *Neometrypus* Desutter, 1988 (Campos and Souza-Dias 2021). The resemblance to cricket nymphs is a notable trait in *Apterotrypa*, which complicates their collection and identification, mainly due to the total absence of wings and the relatively small body size. There is no evolutionary study on organisms that retain juvenile characteristics in the adult stage for this group, but this trait occurs in other taxa of hemimetabolous and holometabolous insects (Strepsiptera: Kathirithamby 1989, Coleoptera: Wong 1996, Dictyoptera: Nalepa and Bandi 2000). Advancing studies on *Apterotrypa* could contribute to understanding morphological reductions such as the retention of juvenile characters during the adult phase.

Apterotrypa species exhibit many similarities in external morphology. All are apterous and lack tympana and stridulatory apparatus. There is also uniformity in their size, head, thorax, most of the abdomen, and the morphology of spines and spurs on their legs. However, several structures allow the distinction of species, such as the supra-anal and subgenital plates and especially parts of the male and female genitalia (except the unknown female of *A. noeli*). Among the characteristics used to differentiate the species, one stands out: the presence of ocelli in *A. mitarakensis* (Campos and Desutter-Grandcolas 2020), which are absent in all others.

This study reveals the existence of metanotal structures in the three new species of *Apterotrypa*, evoking the question of whether the previously described species *A. noeli*, *A. mitarakensis*, and *A. guyanensis* also possess this metanotal structure. These three species were described while pinned and dried, which possibly made it difficult to observe the metanotum, which is covered by the pronotum in this genus. This possibility was formerly suggested by Campos and Desutter-Grandcolas (2020). Further studies on these species are needed to confirm the presence of this structure as a potential diagnostic characteristic of the genus.

Other Grylloidea taxa have similar metanotal structures with glandular functions. In the genus *Eidmanacris* Chopard, 1956 (Phalangopsidae), studies have been conducted on the metanotal gland present in some of its species (Prado and Fontanetti 2005, Campos et al. 2017). In these species, the structure produces a secretion that serves as a nuptial gift offered to the female to stimulate copulation. While the female feeds on the gland's secretion, the male introduces the spermatophore into the female's copulatory papilla (Prado 2006). Although there are no records of courtship and copulation in *Apterotrypa*, it is hypothesized that the metanotal structures identified in males have a similar function. Thus, further studies are necessary to observe the glandular nature of the metanotal structures in *Apterotrypa* and their role in courtship and copulation behavior.

Females of *Apterotrypa assymmetrica* Tonon & Campos, **sp. nov.** and *Apterotrypa endolongata* Tonon & Campos, **sp. nov.** exhibit metanotal projections similar to those of the males, as shown in their respective specimen images (Fig. 1B, Fig. 7B red arrows). Despite their similarity to the male structure, this feature may be vestigial, as it has not been previously described in females of Grylloidea. If confirmed, this would represent the first documented occurrence in the literature. However, the possibility that it is a functional glandular structure for reproduction, as described for males, cannot be discarded. Studies on the metanotal structures of females could clarify aspects of the behavior and provide a better understanding of the biology of *Apterotrypa*, which likely shares convergent traits with other apterous crickets.

In crickets with acoustic communication, the ability to communicate via the stridulatory apparatus and tympanal organs plays a fundamental role in their biology, particularly in reproduction. The loss of this capability may be related to energy costs and predation by sound-oriented predators, such as bats and flies of the family Tachinidae (Lehmann and Heller 1998, Gudin et al. 2024). It is hypothesized that crickets lacking forewing-based acoustic signaling rely on alternative forms of communication. Vibrational signaling through drumming may have replaced acoustic signaling in these crickets (Campos and Desutter-Grandcolas 2020).

Although studies on the genus *Apterotrypa* are still in their early stages, with very few taxonomic works published (Gorochov 2017, Campos and Desutter-Grandcolas 2020) and no studies on their biology, evidence suggests that this group offers a promising field for future scientific research. The absence of wings and acoustic communication, as well as pedomorphic characteristics, raises intriguing questions about how these adaptations may have provided advantages for this genus and influenced intraspecific interactions, particularly in reproduction. With many species yet to be described and the group's biology unknown, additional research is essential to understand the mechanisms that contributed to the evolution of these characteristics. Furthermore, compared to winged crickets, the apterous species of *Apterotrypa* could provide valuable insights into biogeography and evolution in the Neotropics.

Acknowledgments

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